CHAPTER 9. ALTERNATIVES TO TAKE

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CHAPTER 9. ALTERNATIVES TO TAKE

[**Note to Reviewers:** *This is the first draft of Chapter 9 provided to the Steering Committee for review. This draft includes a description of alternative approaches to take associated with each of the components of the proposed Conservation Strategy. The description and evaluation of Alternatives to Take is not included in this draft and will be provided in the next version of Chapter 9. The evaluation of Alternatives to Take will be completed once sufficient information is available from the effects analysis to ensure consistency among the BDCP chapters.*]

9.1 INTRODUCTION

During the development of the BDCP, the Steering Committee identified and considered a broad range of alternate approaches to achieving the planning goals and conservation objectives for the Plan. Among the approaches considered were those that would potentially result in less incidental take of species, including species listed as threatened and endangered under the federal Endangered Species Act (ESA), than would be expected to occur under the proposed actions of the BDCP. This chapter describes the alternatives considered during the development of the BDCP that potentially could further reduce levels of take of federally-listed species covered by the Plan and sets out the reasons such alternates were not incorporated in the proposed project.

9.1.1 Regulatory Standard and Evaluation Criteria

The ESA requires that section 10 permit applicants specify in habitat conservation plans what alternative actions to the taking of federally-listed threatened and endangered species were considered and the reasons why those alternatives are not proposed to be used.[1] The USFWS/NMFS HCP Handbook (USFWS/NMFS 1996) provides guidance to applicants regarding the approach that should be followed with regard to the analysis of alternatives. Specifically, the Handbook identifies two types of alternatives that are typically considered in HCPs: 1) alternatives that would result in take levels below those anticipated for the proposed project, and 2) alternatives that would cause no incidental take, thereby eliminating the need for an incidental take permit. Since the evaluation of alternatives to take is a requirement solely of the ESA, and no similar analysis is required under the NCCPA, the following evaluation is focused on take associated with federally-listed species.[2]

The alternatives to take set out in this chapter were evaluated at two levels: first, various alternative approaches to key components of the BDCP Conservation Strategy and to the

[1] 50 CFR 17.22(b)(1)(iii)(C)

[2] The following description and analysis of Alternatives to Take have been developed solely for the purpose of meeting the requirements of Section 10 of the ESA. As part of the NEPA/CEQA processes, a separate set of project alternatives will be identified and evaluated. The analysis of Alternatives to Take serves a specific regulatory purpose, which is separate and apart from the analysis of project alternatives under NEPA and CEQA. The EIS/EIR for the BDCP will identify a reasonable range of alternatives to the project proposed by the BDCP and evaluate a broad array of potential environmental effects of these alternatives in relation to the likely impacts of the proposed project.

activities covered by the Plan were identified and evaluated individually for their potential to reduce take. Second, these approaches to the key components and activities were assembled in different combinations to create full alternatives to take that could be compared to the proposed Conservation Strategy.[3] The alternative approaches to each component, as well as the full alternatives to take, were evaluated under the following three criteria:

1) level of incidental take expected to result and conservation benefits likely to accrue to listed covered species;

2) consistency with the BDCP overall goals and objectives of ecosystem restoration and water supply reliability; and

3) practicability in light of cost, logistics and technology.

The evaluation sets out the reasons that each of the component variations and alternatives to take were not adopted in the BDCP Conservation Strategy.

9.1.2 Evaluation Process

Over the course of the development of the BDCP, a wide-range of potential approaches were identified and considered for their potential to advance the BDCP dual goals of ecosystem restoration and water supply and reliability. As part of that effort, the Steering Committee evaluated various approaches related to each of the key components that comprise the Conservation Strategy, including approaches to minimizing the potential adverse effects of the BDCP covered activities on threatened and endangered species. After determining which approaches appeared to be the most promising in the context of the dual goals of the BDCP, the Steering Committee developed a comprehensive Conservation Strategy that integrates the key components. This chapter recounts the approaches that were considered by the Steering Committee for each component of the BDCP Conservation Strategy during this process. A detailed history of the development of the BDCP Conservation Strategy and its key components is provided in Appendix D, *Background on the Process of Developing the BDCP Conservation Measures*.

9.2 Alternative Approaches to Components of the BDCP Conservation Strategy

The BDCP Conservation Strategy includes a comprehensive set of actions designed to minimize and mitigate, to the maximum extent practicable, the effects of covered activities on covered species, and provide for the conservation and management of those species. To achieve these outcomes, the Conservation Strategy advances a multi-faceted approach to addressing ecological

[3] The activities that are proposed for regulatory coverage under the BDCP ("Covered Activities") are generally reflected in the BDCP Conservation Strategy. Consequently, the alternative approaches to the BDCP Conservation Strategy incorporate alternative approaches to the Covered Activities that could potentially reduce take of listed covered species.

stressors that adversely affect these species and their habitats. As part of the evaluation of Alternatives to Take, key components of the proposed BDCP Conservation Strategy (which are also activities covered by the Plan) have been considered individually to determine whether other approaches could feasibly be adopted to further reduce take of federally-listed species. The approaches for each conservation strategy component were evaluated, in comparison to the proposed approach in the BDCP Conservation Strategy, based on the criteria described in Section 9.1.1, *Regulatory Standard and Evaluation Criteria*.

Not all of the components of the BDCP Conservation Strategy are addressed in the analysis of alternatives to take. Certain components have not been taken into account because they either do not have the potential to cause significant take of listed species or because no alternative approaches to these actions are available. For instance, the analysis of alternatives to take does not include actions set out in the Conservation Strategy that are designed to reduce the adverse effects of "other stressors" on covered fish species (e.g., illegal harvest). Similarly, actions in the Conservation Strategy to restore and protect non-tidal natural communities to benefit the covered wildlife and plant species were also not factored into the analysis.

This section describes the key components of the BDCP Conservation Strategy, and the alternative approaches considered for each component that potentially could reduce levels of take of federally-listed species. The evaluation of these approaches describes the basis upon which these alternative approaches were not incorporated in the BDCP Conservation Strategy. The potential adverse and beneficial effects on covered listed species associated with the various alternative approaches in comparison to the key components of the proposed Conservation Strategy are summarized in Table 9-1.

9.2.1 Approaches to Water Conveyance Infrastructure

The water conveyance infrastructure component of the BDCP Conservation Strategy consists of proposed new or existing facilities, and their associated features, that would be used to convey water for export through the SWP and/or CVP).

9.2.1.1 BDCP Proposed Action

The BDCP includes provision for the development of an isolated conveyance facility that will consist of a sub-surface Tunnel/Pipeline that will connect five new intakes on the Sacramento River and carry water from the Sacramento River in the north Delta to the existing south Delta SWP and CVP export facilities (see Chapter 3, *Conservation Strategy*, Chapter 4, *Covered Activities*, and Appendix M.4, *Fish Facilities Technical Team Report*, for more details). Through the establishment a new point of diversion for water export, the BDCP provides for two different means to convey water, which will minimize adverse effects associated with the SWP and CVP on federally-listed and other at-risk fish species.

The proposed isolated Tunnel/Pipeline conveyance facility reflects the outcome of several years of deliberations by the BDCP Steering Committee's Conveyance Working Group, the Habitat

and Operations Technical Team, the Integration Team, and DHCCP engineers. A Tunnel/Pipline will require a much smaller surface footprint than other isolated conveyance approaches that would involve surface canals. As such, the Tunnel/Pipeline approach will result in substantially smaller impacts to natural communities and habitats than a canal, thereby reducing levels of incidental take on terrestrial covered species. Dual operations of the new north and existing south Delta pump facilities will provide for operational flexibility to further avoid or minimize impacts to covered fish species that may otherwise occur as a result of seasonal sensitivities or spatial distributions of covered fish species, and also achieve project goals for water supply.

9.2.1.2 Alternative Approaches

Over the course of developing and selecting the proposed conveyance facility, the BDCP Steering Committee's Conveyance Working Group, the Habitat and Operations Technical Team, the Integration Team, and DHCCP engineers identified and evaluated a range of approaches to new water conveyance infrastructure, including the following alternative approaches (see Figure 9-1).

- **Canal:** Would consist of a surface canal facility with siphons under major channels and associated surface infrastructure (e.g., forebays, access roads, electrical transmission lines). The canal would extend from the new north Delta water intake facilities to Clifton Court Forebay, and would be sized to a capacity allowing for diversion of up to 15,000 cfs.
    - East side of Delta configuration
    - West side of Delta configuration
- **Through-Delta:** Would involve the use of existing and modified infrastructure to move water through the Delta to existing south Delta intake facilities. Variations of the Through-Delta approach include:
    - Reinforcement of levees along conveyance channels to reduce risk of failure from seismic and flood events (open with improvements).
    - No conveyance facility improvements.
    - Reinforcement of levees, gates separating Old and Middle rivers, and a siphon under Old River to Clifton Court Forebay, such that export water conveyance through Middle River would be separated from habitat supporting flows on Old River (Separate Corridors).

9.2.1.2.1 East-Side Canal

The use of an East-Side Canal to convey water would not result in lower level of take of federally-listed species than the conveyance component of the BDCP Conservation Strategy. The development of an east-side canal would result in greater impacts to listed species than the

development of a tunnel/pipeline (Table 9-1). For example, the East-Side Canal alignment would cause greater loss than a tunnel/pipeline of agricultural foraging habitat used by Swainson's hawk, white-tailed kite, and greater sandhill crane. The East Canal alignment would also remove a greater amount of riparian and other woodland nesting habitat for Swainson's hawk and white-tailed kite and directly affect a greater number of documented nesting territories, including removal of nest trees. Loss of potential habitat for yellow-breasted chat, least Bell's vireo, yellow-billed cuckoo, and valley elderberry longhorn beetle would be substantially greater under this approach than under the Tunnel/Pipeline alignment. The East-Side Canal alignment would also have a greater affect on small streams, irrigation canals, ponds, associated freshwater emergent wetlands, and surrounding agricultural lands, which provide habitat for tri-colored blackbird, giant garter snake, western pond turtle, and many other native species. The East-Side Canal would also have greater affect on aquatic invertebrates through removal of vernal pools and other seasonal wetlands in the vicinity of Stone Lakes NWR than the proposed approach to conveyance infrastructure.

Furthermore, construction of an East-Side Canal would fragment habitat supporting the Caldoni Marsh/White Slough subpopulation of giant garter snake and possibly preclude the ability to achieve recovery objectives for subpopulation. The East-Side Canal alignment would also create a substantial barrier, relative to the proposed Tunnel/Pipeline, to movement throughout its length, affecting movement of numerous terrestrial wildlife species and several Covered Species including giant garter snake, California tiger salamander, western spadefoot toad, and western pond turtle.

9.2.1.2.2 West-Side Canal

The development of a canal in the western portion of the Delta was similarly rejected because it would result in a higher level of take of listed species than a Tunnel/Pipeline. The West-Side Canal alignment would result in take of more listed species and would result in a greater amount of take than would result from the proposed Tunnel/Pipeline configuration (Table 9-1). The West-Side Canal alignment would remove a substantially greater amount of agricultural foraging habitat and riparian nesting habitat for Swainson's hawk and white-tailed kite than the proposed Tunnel/Pipline. Greater loss of riparian habitat would affect yellow-breasted chat, least Bell's vireo, yellow-billed cuckoo, and valley elderberry longhorn beetle. Relative to the proposed Tunnel/Pipeline, the West-Side alignment would affect a greater amount of emergent marsh habitat along small streams and irrigation canals and surrounding agricultural and pastureland that potentially supports tri-colored blackbird, giant garter snake, western pond turtle, and a variety of other marsh-associated species. This alignment would also affect habitat in the Central Delta that supports the California black rail, and would result in greater habitat loss and potential for direct take of California red-legged frog, California tiger salamander, and San Joaquin kit fox in the vicinity of Clifton Court Forebay.

Similar to a canal with an eastern alignment, a West-Side Canal would create a substantial barrier to movement of various species, including western pond turtle, giant garter snake and many other reptiles, amphibians, and mammals.

9.2.1.2.3 Through-Delta Conveyance—Existing Conditions

The two different Through-Delta approaches to water conveyance, one that uses existing infrastructure and one that includes in-Delta improvements, were each rejected from consideration because they would not achieve BDCP water export objectives, would maintain the current north-south flow patterns through the Delta that impede fish movement, and would limit the extent and location of tidal habitats that could be restored (or reduce the habitat function if restored) in the Delta because restored habitat and associated aquatic food production would not be isolated from effects of operating the SWP/CVP south Delta pumping facilities (Table 9-1).

These Through-Delta approaches would result in greater levels of take of delta smelt, longfin smelt, San Joaquin River salmonids, and other covered species as a result of entrainment than will likely occur under dual operations of the proposed Tunnel/Pipeline and the south Delta diversions. Under a conveyance approach that relies solely on the south Delta diversions, the Delta channels would continue to serve as the infrastructure to transport water north to south, which would adversely affect fish migration and movement patterns relative to proposed dual operations.

Through-Delta conveyance would reduce the ecological functions and benefits of restored tidal or floodplain habitat in east or south Delta relative to the proposed project (e.g., South Delta and Cosumnes/Mokelumne ROAs). Nutrients, organic material, food, and fish derived from restored habitats would be subject to the entrainment effects of the South Delta pump facilities that would be much greater than under the proposed project.

While the Through-Delta approach would result in less effects on terrestrial wildlife that use grasslands and agricultural lands than the proposed Tunnel/Pipeline conveyance approach, any reinforcement and upgrading of levees would result in greater levels of take of riparian species than the proposed Tunnel/Pipeline. Riparian species affected by the Through-Delta (open with improvements) approach to a greater extent than under the proposed Tunnel/Pipeline include Swainson's hawk, yellow-breasted chat, least Bell's vireo, yellow-billed cuckoo, white-tailed kite, and valley elderberry longhorn beetle.

9.2.1.2.4 Through-Delta Conveyance—Separate Corridors

The Through-Delta-Separate Corridors approach to conveyance infrastructure was rejected because it would not achieve BDCP water export objectives, it would limit the extent and location of tidal habitats that could be restored in the Delta, and, because this approach requires operation of barriers, impede local and migration movements of listed species through the Delta (Table 9-1).

The use of separate corridors would result in greater levels of entrainment take of delta smelt, longfin smelt, Sacramento River and Mokelumne/Cosumnes River salmonids, and other covered species from the Sacramento River than under dual operation of the Tunnel/Pipeline. Velocities in the corridor used for conveyance (Middle River when this was originally evaluated) would be much higher than existing velocities for a given south Delta export rate, making it even more difficult for weak-swimming fish the ability to swim away from flows heading towards the pumps. With only south Delta diversions the Delta channels must continue to be used to transport water north to south adversely affecting fish migration and movement patterns relative to the more flexible proposed dual operations.

The Separate Corridors conveyance would reduce the ecological functions and benefits of restored tidal or floodplain habitat in the east Delta relative to the proposed project (e.g, Mokelumne/Cosumnes ROA). Nutrients, organic material, food, and fish derived from restored habitats would be subject to the entrainment effects of the South Delta pump facilities that would be much greater than under the proposed project. While separate corridors would allow for greater tidal and floodplain habitat restoration opportunities along the Old River corridor it would limit opportunities for habitat restoration along the San Joaquin River and Middle River, North Fork Mokelumne, and South Fork Mokelumne relative to the BDCP proposed action.

Separate Corridors conveyance would result in less adverse effects on terrestrial wildlife that use grasslands and agricultural lands than the proposed Tunnel/Pipeline, the reinforcement and upgrading of levees would result in greater levels of take of riparian species than the proposed Tunnel/Pipeline. Riparian species would be affected by Separate Corridors conveyance to a greater extent than under the proposed Tunnel/Pipeline, including Swainson's hawk, yellow-breasted chat, least Bell's vireo, yellow-billed cuckoo, white-tailed kite, and valley elderberry longhorn beetle.

9.2.2 Approaches to Water System Operations

9.2.2.1 BDCP Proposed Action

Under the BDCP Conservation Strategy, long-term (approximately years 11-50 of plan implementation) water operations will involve the use of both the new intakes and Tunnel/Pipeline in the north Delta and the existing intakes in the south Delta (referred to as "dual operations"). The BDCP conservation measures include specific initial North and South Delta operating criteria and adaptive ranges that will govern the operation of the water conveyance systems (see Section 3.4.2.1, *Water Operations and Facilities*). The proposed water system operations reflects the outcome of several years of deliberations by the BDCP Steering Committee's Conveyance Working Group, the Habitat and Operations Technical Team, the Integration Team, and three separate effects evaluation processes conducted by teams of fisheries biologists and other experts in developing the long term operational criteria (see Appendix D, *Background on the Process of Developing the BDCP Conservation Measures*).

The proposed North and South Delta operations criteria are designed to achieve water export objectives while minimizing the take of listed fish species by limiting operations during periods each of the species are most vulnerable to operations-related take. In developing the proposed operations of the dual facilities, a broad range of operating criteria were considered and evaluated for both the north and south Delta facilities individually and for the north and south Delta facilities in tandem (i.e., dual operations) to meet the goals of conserving covered fish species and providing for reliable water exports. Factors considered in the evaluation of operations included:

- Reverse flows on Old and Middle rivers and entrainment at the south Delta SWP and CVP facilities;
- San Joaquin River inflows and relationship between inflow and exports at the south Delta facilities;
- Flow velocities on the Sacramento River and functional requirements of the north Delta fish screen facilities;
- Transport flows on the Sacramento River and its distributaries;
- Relationship of bidirectional and unidirectional flow on the Sacramento River and the functioning of intake and screen facilities;
- Similarity of proposed operations to the shape of a natural hydrograph with unimpaired flows;
- Pulse flows on the Sacramento River;
- Delta outflow and X2 location;
- Effects of Delta operational criteria on reservoir operations and support of reservoir cold water pools;
- Effects of operations on Delta salinities as they relate to existing salinity standards for both agricultural and municipal/industrial intakes;
- Hydrodynamic relationships between proposed BDCP tidal habitat restoration and water operations; and
- Effects of sea level rise and changes in hydrograph from climate change.

See Appendix D, *Background on the Process of Developing the BDCP Conservation Measures*, for more detail on the range of operational criteria evaluated during development of the proposed BDCP water operations.

The proposed long-term operational criteria represent an optimized solution to various uses of water in the system. Dual operations of north and south intakes provided for minimization of impacts on Sacramento River and San Joaquin River fish while providing for water supply reliability. Specific actions, such as allowing Sacramento River "pulse flows" past the north

Delta intakes for fish transport, but also allowing some minimum export diversions at those intakes represents one trade-off that minimizes take. Using the south Delta intakes to allow greater Sacramento River attraction and transport flows provided a means for minimizing impacts on Sacramento River fish and using the north Delta intakes to allow for positive or less negative flows on Old and Middle Rivers provided a means for minimizing impacts on San Joaquin River and estuarine fish. Maintaining sufficient cold water pool in Shasta and Oroville reservoirs to support releases for salmonid species conservation was evaluated as a trade-off with Delta outflows and exports such that impacts on both salmonid eggs and larvae and estuarine fish, especially delta and longfin smelt, were minimized.

Included in the proposed operations is an operational adaptive range that allows for changes from the initial operations through the BDCP adaptive management program (Section 3.7, *Adaptive Management Program*) that would reduce adverse effects or enhance beneficial effects on fish as more is learned through the BDCP monitoring and research program (Section 3.6, *Monitoring and Research Program*).

9.2.2.2 Alternative Approaches

Over the course of developing and selecting the proposed North and South Delta Criteria, the BDCP Steering Committee's Conveyance Working Group, the Habitat and Operations Technical Team, and the Integration Team identified and evaluated a range of water operations criteria, including the following alternative approaches. These other approaches to water operations were evaluated, but not adopted, because they would likely result in greater levels of take than the proposed approach to water operations. Other operational approaches were rejected because they would result in substantial curtailment of exports and not meet the project purpose for water supply reliability (Table 9-1). Evaluated alternative approaches include:

- Existing South Delta Criteria (No Project). Assumes continued operations of south Delta SWP and CVP facilities with through-Delta conveyance only under currently authorized operational criteria.
- Increased Restrictions on North and South Delta Criteria (Reduced Export). Provides for additional restrictions on operations of intake facilities for export and therefore a reduction in average annual export.
- No exports.

9.2.2.2.1 Existing South Delta Criteria (No Project)

[***Note to Reviewers:*** *this evaluation will be expanded in the next version of this Chapter.*]

Continuance of existing operations of south Delta SWP and CVP facilities was rejected as an alternative to take because this approach would not achieve BDCP water export objectives (Table 9-1). Additionally, this approach would result in greater levels of entrainment take for

delta and longfin smelt, splittail, Sacramento and Mokelumne/Cosumnes River salmonids and lamprey, green and white sturgeon.

9.2.2.2.2 Increased Restrictions on North and South Delta Criteria (Reduced Export)

[***Note to Reviewers:*** *this evaluation will be expanded in the next version of this Chapter.*]

Increasing operational restrictions on north and south Delta exports was rejected as an alternative to take because this approach would not achieve BDCP water export goals (Table 9-1). The proposed North and South Delta operations criteria are designed to achieve water export objectives while minimizing the take of listed fish species by limiting operations during periods each of the species are most vulnerable to operations-related take.

9.2.2.2.3 No Water Exports through Project Facilities

[***Note to Reviewers:*** *this evaluation will be expanded in the next version of this Chapter.*]

The cessation of water exports through the CVP/SWP Delta facilities was rejected as an alternative to take because this approach would not achieve BDCP water export goals (Table 9-1).

9.2.3 Approaches to Water Intake Structures

The water intake structures include new water intake structures that would be constructed along the Sacramento River in conjunction with an isolated conveyance facility.

9.2.3.1 BDCP Proposed Action

The BDCP proposes the construction of five new water intake structures in the north Delta located along the Sacramento River between Freeport and Sutter Slough to serve collectively as a new point of diversion for water export and allow for dual operations of the conveyance system to minimize adverse effects of the SWP and the CVP on federally-listed and other at-risk fish species and advance the goal of water supply reliability. Each of these proposed new intake structures will have the capacity to pump water at 3,000 cfs and will be outfitted with state-of-the art positive barrier fish screens (see Section 3.4.2.1, *CM1: Water Facilities and Operations*, and Appendix M.2, *Fremont Weir and Yolo Bypass Improvements*, for more details). These positive barrier fish screens have been designed to minimize entrainment and impingement of covered fish species, particularly Sacramento River Basin Chinook salmon and Central Valley steelhead, delta smelt, and Sacramento splittail. The Steering Committee developed the concept of diverting water from the north Delta as a structural approach to substantially reduce entrainment of listed and non-listed covered fish species at the current south Delta SWP and CVP intake facilities.

9.2.3.2 Alternative Approaches

During the BDCP planning process, a range of intake locations, designs, sizes, and fish screen types were evaluated (see Appendix M.4, *Fish Facilities Technical Team Report*) to determine their capacity to reduce take, including the following alternative approaches.

- Un-Screened Intakes Between Freeport and Sutter Slough on the Sacramento River, and
- Screened Intakes Below Sutter Slough on the Sacramento River.

9.2.3.2.1 Un-Screened Intakes Between Freeport and Sutter Slough on Sacramento River

The approach of not screening the new intakes was rejected because it would result in greater risk for take through entrainment of juvenile Sacramento River Basin Chinook salmon and Central Valley steelhead during outmigration, of delta smelt during the spawning period, and of larval/juvenile Sacramento splittail than the proposed project in which intakes are screened (see Table 9-1).

9.2.3.2.2 Screened Intakes Below Sutter Slough on Sacramento River

[***Note to Reviewers:*** *this evaluation will be expanded in the next version of this Chapter.*]

Locating 2 of the 5 intakes below Sutter Slough would reduce the risk of take relative to the proposed project for some Sacramento River Basin Chinook salmon and Central Valley steelhead that pass into Sutter and Steamboat sloughs. Delta smelt would be exposed to a slightly greater level of take than under the proposed project with these two intakes farther downstream. Locating 2 of the 5 intakes below Sutter Slough on the Sacramento River was rejected because the salinity of the water at this location would not meet water quality export objectives during some periods, particularly in future years with sea level rise (Table 9-1).

9.2.4 Approaches to Yolo Bypass Fisheries Enhancement

The Yolo Bypass fisheries enhancement program includes improvements to the Fremont Weir and structural improvements to water conveyance and other flood conveyance facilities in the Yolo Bypass to improve habitat conditions and passage for the covered fish species.

9.2.4.1 BDCP Proposed Action

The BDCP Conservation Strategy includes a range of proposed improvements to the Fremont Weir and the Yolo Bypass to enhance floodplain habitat and improve passage for covered fish species. The Steering Committee selected these habitat enhancement measures based on results of extensive studies indicating that 1) when the Bypass is inundated, substantial benefits are provided to Sacramento River runs of Chinook salmon (rearing habitat, reduced predation exposure, increased growth rates) and Sacramento splittail (spawning and rearing habitat), 2)

upstream passage by adult Chinook salmon and sturgeon through the Bypass is substantially impeded by several barriers, preventing access to spawning habitats and increasing loss to illegal harvest, 3) the current topography of the Bypass causes stranding of listed and other at-risk fish species following inundation events, and 4) leakages occurring at current flood control structures attract anadromous fish to false migration pathways. To optimize the benefits expected of this conservation measure and to minimize adverse effects of the current Bypass configuration on covered species, different approaches related to physical improvements and water operations were evaluated.

9.2.4.1.1 Fremont Weir Improvements

Improvements to Fremont Weir under the proposed project include lowering of a weir section and installation of gates to create a flood channel capable of carrying Sacramento River flows to the Yolo Bypass at a lower stage such that flows in the Bypass can be controlled for greater frequency and longer duration that will benefit covered fish species. These changes to floodplain hydrology would increase splittail spawning success and the growth and survival of juvenile Sacramento River salmonids that use the Bypass. To achieve these benefits for covered fish species, removal of habitat and potential take of terrestrial wildlife species would result from construction of the new flood channel. The avoidance of such take would require that the flood channel not be constructed, which would prevent the intended benefits of this measure from occurring. During the development of this conservation measure, efforts were taken to minimize likely impacts to terrestrial habitats, specifically riparian habitat, by adjusting the location and configuration of the proposed new flood channel.

Construction of the new flood channel from the Sacramento River to the new gate structure and from the gate structure to the bypass will result in the loss of habitat for covered species that use riparian and grassland habitats, including Swainson's hawk, white-tailed kite, yellow-breasted chat, least Bell's vireo, and yellow-billed cuckoo. Various locations and configurations of the new flood channel were considered to minimize impacts on riparian habitat. Though final channel design has not been determined, the allowable configuration has been constrained to limit impacts to the lowest function riparian habitat (i.e., riparian scrub habitat that is regularly removed under the existing flood control maintenance and operations) and avoid all stands of mature riparian forest (see Chapter 5, *Effect Analysis,* for more detail on riparian impacts). Other flood channel locations with greater impacts on riparian habitat than the proposed range of configurations were considered and rejected because they could result in greater levels of impact on habitat suitable for Swainson's hawk, white-tailed kite, yellow-breast chat, least Bell's vireo, yellow-billed cuckoo, and valley elderberry longhorn beetle.

9.2.4.1.2 Floodplain Improvements and Operations

Enhancements to floodplain hydrology in the Yolo Bypass would increase splittail spawning success and the growth and survival of juvenile salmonids that use the Bypass. To achieve these benefits for covered fish species, periodic impacts on terrestrial and wetlands habitats and potential take of terrestrial wildlife species would result. For example, increased inundation

duration and frequency will temporarily convert to open water aquatic habitat patches of emergent wetland, managed wetland, and agricultural habitat used by burrowing owl, Swainson's hawk, and white-tailed kite. While habitat will be reduced during inundation periods, the extent of temporarily inundated habitat would not substantially affect local breeding populations of these and other species that occur in the Yolo Bypass. While during flood years inundation duration will be increased relative to the current condition, habitat will be affected mainly during winter and early spring season and will gradually recover during the late spring and summer. This action will have a temporary seasonal effect on species that use the bypass lands for foraging, but it is not likely to result in a substantial change in distribution or abundance of these covered species.

Tricolored blackbird may be affected from the increase of frequency and duration of flooding. The extent to which these changes will influence the quality of tri-colored blackbird nesting habitat and associated foraging habitat is unclear. This species appears to be sensitive to relatively minor changes in food availability and will readily abandon nesting when food availability is insufficient. Increases in frequency and duration of flooding in the Yolo Bypass may affect the quality of tricolored blackbird habitat to the extent that local breeding populations could be reduced.

Giant garter snake may be affected from the increase of frequency and duration of flooding. However, events will occur mainly during the snake's inactive period when they are less likely to be in the Bypass. While there have been relatively few documented occurrences, the species has been detected within the bypass. It is unlikely that giant garter snakes traditionally overwinter within the bypass because the Bypass has been periodically inundated during winter months for decades (Fremont Weir was constructed in 1924). Instead, those snakes that use the Bypass during the active season are more likely to find overwintering habitat on the Bypass levees or outside of the bypass during the winter. Thus, while there is some uncertainty due to the lack of data, an increase in winter and early spring inundation duration and frequency may not substantially affect the giant garter snake. To further reduce the potential for take, other design elements are included in the Plan, such as the construction of berms to direct floodwaters away from the most sensitive habitats.

9.2.4.1.3 Fish Passage Improvements

Fish passage improvements are designed to benefit covered fish species by reducing migration delay and straying losses and would result in no or minimal adverse effects on covered species. These are site-specific actions to remove impediments to fish movement (including Sacramento River runs of Chinook salmon and steelhead, sturgeon, and splittail) in the Yolo Bypass, at the Fremont Weir, Sacramento Weir, and Lisbon Weir. Various alternative designs have been and will be evaluated for improving fish passage, including adding culverts to existing agricultural crossings of the toe-drain, construction of new fish ladders and ramps on the Fremont Weir, and construction of a low-flow fish passage channel and gates within the proposed new flood flow

channel and gates at the Fremont Weir. None or the alternative designs would have less impact on covered fish species than the proposed project.

9.2.4.2 Alternative Approaches

The assessment of different approaches to enhance the Yolo bypass included consideration of the following approaches.

- NMFS Biological Opinion (2009) - Reasonable and Prudent Alternative (RPA) for Yolo Bypass Improvements. Includes all elements of the Proposed Conservation Strategy approach except for Sacramento Weir improvements
- No improvements to the Fremont Weir or Yolo Bypass. Conditions as they currently exist under the flood bypass system would not be changed pursuant to the BDCP.

9.2.4.2.1 NMFS Biological Opinion

Implementation of this approach was rejected because it would provide fewer benefits for improving passage of salmonids and sturgeon through the Yolo Bypass by not including improvements to the Sacramento Weir (see Table 9-1).

9.2.4.2.2 No Improvements to the Fremont Weir or Yolo Bypass

Implementation of this approach was rejected because it would not achieve the BDCP conservation objectives for Chinook salmon, green and white sturgeon, and Sacramento splittail (see Table 9-1).

9.2.5 Approaches to Habitat Restoration

The habitat restoration component of the conservation strategy consists of actions to restore tidal, seasonally inundated floodplain, and channel margin habitats to benefit covered aquatic species by expanding and improving habitat and enhancing the available food supply.

9.2.5.1 BDCP Proposed Action

The BDCP Conservation Strategy includes measures to restore areas to further expand and improve habitat conditions for covered fish, wildlife, and plant species and ecosystem functions. Under the Plan, 65,000 acres of tidal, 10,000 acres of seasonally inundated floodplain, 5,000 acres of riparian, and 20 miles of channel margin habitat are proposed for restoration. The restoration of 5,000 acres of riparian habitat would occur as an ecological component of the restoration of tidal, floodplain, and channel margin habitats. A wide range of restoration measures were evaluated by the Steering Committee's Habitat Restoration Technical Team and Terrestrial Resources Subgroup for their potential to benefit fish, wildlife, and plant species covered by the BDCP. In developing habitat restoration actions for aquatic species, certain "trade-offs" were made between species that would benefit from the restoration and creation of

aquatic and tidal wetlands habitats and those that would be adversely affected by the conversion of terrestrial and non-tidal wetland habitats.

9.2.5.1.1 Tidal Habitat Restoration

Tidal habitat restoration actions are intended to improve aquatic food web processes for covered fish species and to increase the extent of marsh plain habitat for covered tidal marsh associated wildlife and plant species. Tidal habitat restoration will also increase the extent of subtidal aquatic habitat for the covered fish species. Restoration of tidal habitat will result in take of listed vernal pool shrimp and plant species and covered wildlife species associated with agricultural, grassland, vernal pool, riparian, and existing tidal marsh habitats that would be removed by the tidal habitat restoration action. Affected covered species include vernal pool fairy shrimp, vernal pool tadpole shrimp, conservancy fairy shrimp, mid-valley fairy shrimp, California linderiella, California tiger salamander, western spadefoot toad, salt marsh harvest mouse, Suisun shrew, Suisun song sparrow, California clapper rail, California black rail, white-tailed kite, Swainson's hawk, tri-colored blackbird, greater sandhill crane, burrowing owl, least Bell's vireo, yellow-breasted chat, yellow-billed cuckoo, Townsend's big-eared bat, alkali milk vetch, heartscale, brittlescale, San Joaquin spearscale, Suisun thistle, soft birds-beak, dwarf downingia, Boggs Lake hedge-hyssop, Carquinez goldenbush, Delta tule pea, legenere, Heckard's peppergrass, Mason's liliopsis, Delta mudwort, Suisun marsh aster, and side-flowering skullcap.

To minimize the extent of take, the suitability of lands for restoration within the Plan Area was evaluated to identify locations with the highest suitability for achieving BDCP tidal habitat restoration objectives, thereby minimizing the extent of existing habitat area that would be required to achieve the objective to restore 65,000 acres of tidal habitat that supports as much tidal marsh as practicable. Alternative approaches to achieving this objective would require use of less suitable lands and thus require a greater area of land to restore a similar amount of tidal marsh as the proposed action and hence would result in greater impacts on covered species.

Various amounts and distributions of tidal freshwater habitat (marsh and subtidal aquatic) were considered in the development of the proposed habitat restoration measures (see Appendix D, *Background on the Process of Developing the BDCP Conservation Measures*). The proposed ROA locations, restoration targets by ROA, and total restoration targets were developed to maximize benefits of physical habitat for the covered fish species and of marsh and mudflat for covered wildlife and plant species that use such habitat. Alternatives that would result in lower levels of restored tidal habitats would also result in less take of terrestrial covered wildlife and plant species, but in less benefit to freshwater tidal covered species that are most at risk (fish and tidal wetland plants). Less than 3% of historic tidal freshwater marsh habitat remains in the Delta (less than 9,000 acres), mainly as a result of land reclamation to increase agricultural uses (currently over 500,000 acres). There are no other ecologically appropriate locations for restoration of Delta fisheries and native plant habitat other than in the Delta itself. Approaches to

restore less freshwater tidal habitat in the Delta were rejected because they would not meet the species conservation goals of the BDCP.

While construction activities related to restoration will initially disturb existing brackish tidal marsh habitat, restoration of these areas will ultimately result in a net increase in the extent and quality of habitat for species that utilize this habitat type, including salt marsh harvest mouse, California clapper rail, California black rail, Suisun shrew, and Suisun song sparrow. Take of these species resulting from restoring tidal habitat in Suisun Marsh will be entirely avoided through the implementation of the avoidance measures described in Chapter 3, *Conservation Strategy*. Existing tidal and non-tidal habitats supporting these species and Suisun thistle and soft bird's-beak in Suisun Marsh could be removed as a result of dampening of the tidal range and inundation of non-tidal habitats that will result from establishing tidal flow into restored habitats. Restoring tidal habitat in Suisun Marsh, however, will result in an increase of about 3,300 to 4,500 acres of California clapper rail habitat, 800 to 2,300 acres of salt marsh harvest mouse habitat, and 3,000 to 4,200 acres of Suisun thistle and soft bird's-beak habitat. Implementation of BDCP tidal restoration measures in Suisun Marsh will contribute to achieving the objectives of USFWS's Draft Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California.[4]

A restoration program that did not include tidal habitat restoration in Suisun Marsh was rejected because such an approach would substantially limit the ability of the BDCP to achieve biological goals and objectives for the covered fish, wildlife and plant species.

9.2.5.1.2 Seasonal Floodplain Restoration

Seasonally inundated floodplain habitat restoration actions are intended primarily to restore habitat for Sacramento splittail spawning and Chinook salmon, steelhead, and Sacramento splittail rearing,and also to improve aquatic food production in adjacent waterways for other covered fish species. Additionally, restored floodplains will provide locations for restoration of riparian habitat that will provide structural complexity and improve food production for covered fish during floodplain inundation periods and provide habitat for riparian associated covered wildlife and plant species, including Swainson's hawk, white-tailed kite, yellow-breasted chat, least Bell's vireo, yellow-billed cuckoo, riparian woodrat, and riparian brush rabbit.

The proposed floodplain restoration actions may result in the removal of currently unoccupied riparian habitat for woodrat, riparian brush rabbit, and least Bell's vireo if implemented in the south Delta where the most suitable restoration opportunities are available, but would also result in a substantial net gain in habitat for these species over the term of the BDCP. Direct mortality of riparian woodrat and riparian brush rabbit that could result from floodplain restoration in the south Delta will be avoided through the implementation of measures identified in Chapter 3, *Conservation Strategy*.

[4] 75 FR 27:6696-6697 February 10, 2010; USFWS 2010.

9.2.5.1.3 Channel Margin Habitat Restoration

Channel margin restoration actions could result in adverse effects on covered fish species within the immediate vicinity during construction from such stressors as increased sediment load and noise. Best management practices are included in the BDCP to avoid and minimize such impacts. These channel margin restoration projects would be conducted along existing levees, mostly riprap covered, that currently provide little or no habitat for covered species and do provide habitat for non-native predators that consume covered species of fish.

9.2.5.2 Alternative Approaches

During the BDCP planning process, a number of alternative approaches to the restoration of tidal, floodplain, riparian, and channel margin habitats were considered, including the following.

- Tidal Habitat Restoration (which would include restored tidal marsh, subtidal aquatic, and transitional upland habitat):
    - Restoration of 30,000 acres in Cache Slough Complex, Suisun Marsh, West Delta, and modified-South Delta ROAs.
    - Restoration of 8,000 acres in the Cache Slough Complex ROA.
    - No tidal habitat restoration.
- Seasonally Inundated Floodplain Restoration
    - Restoration of 20,000 acres of restored seasonally inundated floodplain.
    - No floodplain restoration.
- Channel Margin Habitat Enhancement
    - Enhancement of 40 miles of channel margin habitat. .
    - No enhancement of channel margins.
- Riparian Habitat Restoration
    - Restored riparian habitat would be limited to that habitat which is naturally established as a result of associated tidal habitat restoration. Depending on the approach adopted for tidal habitat restoration, an estimated 20-950 acres of riparian habitat could be restored. This approach would be implemented if a seasonally inundated floodplain habitat is not part of the restoration program.
    - No restoration of Riparian habitat. *Tidal Habitat Restoration*

Tidal marsh restoration of 8,000 acres in the Cache Slough Complex ROA is similar to the actions described in the existing USFWS Biological Opinion. It would result in fewer benefits for covered fish and tidal habitat-associated covered wildlife and plant species than the proposed

action, but would also result in less adverse effects on terrestrial wildlife and plant species. No benefits would be provided to covered wildlife and plant species endemic to the Suisun Marsh.

Under the No tidal habitat restoration option all adverse tidal habitat restoration-related effects on terrestrial and non-tidal wetland associated covered wildlife and plant species would be avoided. However, no benefits would accrue to covered fish and tidal habitat-associated covered wildlife and plant species.

Approaches that would involve the restoration of less t tidal habitat , as discussed above, would involve less take of listed and nonlisted covered wildlife and plant species than the proposed action. These approaches were rejected, however, because they would not advance the conservation objectives for the covered fish species. Insufficient habitat and food are hypothesized to be major stressors limiting covered fish species populations. Consequently, severe limitations in the amount of tidal habitat proposed for restoration in the BDCP would compromise the effectiveness of the Conservation Strategy to sufficiently address these stressors (see Appendix D, *Background on the Process of Developing the BDCP Conservation Measures*).

9.2.5.2.1 Seasonal Floodplain Restoration

An increase of 10,000 acres of restored floodplain habitat would increase benefits for covered salmonids and Sacramento splittail. The habitat restoration component of the BDCP does not propose restoration at this level because of practicability concerns and the significant increase in impacts on covered wildlife species (Table 9-1). The elimination of all floodplain restoration from the BDCP Conservation Strategy was rejected because alternative approaches to increasing splittail spawning habitat area and salmonid floodplain rearing habitat area at sufficient levels are not available. In addition, without the floodplain restoration component of the BDCP, restoration of riparian forest and scrub under natural hydrologic conditions would not occur because other suitable sites for such restoration are not available in the Plan Area. Although restoration of seasonal floodplain will result in take of listed plant and wildlife species, on balance, the benefits to Chinook salmon or Sacramento splittail appear to outweigh the detriments to these terrestrial species (Table 9-1).

9.2.5.2.2 Channel Margin Habitat Restoration

The restoration of an additional 20 miles of channel margin habitat over the levels proposed in Conservation Strategy would achieve the same types of conservation benefits as the proposed action. However, the additional enhancements would provide greater benefit to salmonids than the proposed actions of the BDCP. Adverse effects would be the same as described for the proposed action except that the extent of effects would be greater. This alternative was rejected because of the uncertain benefits that would be realized for rearing salmonids beyond those that would result from the proposed restoration of 20 miles of habitat along the most important salmonid migration corridors. The proposed action, however, includes the potential for additional channel margin habitat restoration to occur through the adaptive management process

in the event that monitoring of salmonid responses to such restoration suggests that such actions would provide significant additional benefits.

The elimination of channel margin habitat restoration from the Conservation Strategy was considered and rejected because of the value of such restoration to covered fish species, particularly salmonids. The enhancement of channel margin habitat along key migration corridors will increase survival of covered fish species by creating conditions that will reduce loss through predation (Table 9-1).

9.2.5.2.3 Riparian Habitat Restoration

The reasons for rejecting alternative approaches to riparian habitat are the same as those set out for alternative approaches to the restoration of tidal, floodplain, and channel margin habitats.

Table 9-1. Assessment of Alternative Approaches to the Components of the Conservation Strategy Relative to the Proposed Conservation Strategy

Component and Approach	*Evaluation Criteria*				
	Avoid & Minimize Take of Aquatic species	**Avoid & Minimize Take of Terrestrial Species**	**Meet Project Purpose for Species Conservation**	**Meet Project Purpose for Water Supply**	**Practicability**
Water Intake Structure—Proposed: Screened Intakes Between Freeport and Sutter Slough on Sacramento River					
Un-screened Intakes Between Freeport and Sutter Slough on Sacramento River	Greater entrainment of covered fish species using the Sacramento River	Same level of effects	Not consistent with objectives to reduce entrainment risk	No change in water supply	*[To Come]*
Screened Intakes Below Sutter Slough on Sacramento River	Slightly greater entrainment risk for delta smelt and less entrainment risk for covered salmonids	Similar level of effects	Slight tradeoff in benefits between covered salmonids and delta smelt	Risk of reduced water supply resulting from more frequent bidirectional flow, salinity, and sea level rise	*[To Come]*
Screened Intakes Above Freeport and on Sacramento River	Less entrainment of delta smelt, no change in entrainment of covered salmonid species	Reduction in removal of riparian habitat on levees	Decreased entrainment risk for delta smelt	Reduction in risk of reduced water supply resulting from more frequent bidirectional flow, salinity, and sea level rise	*[To Come]*
Screened Intakes Above the City of West Sacramento on Sacramento River	Less entrainment of delta smelt, no change in entrainment of covered salmonid species	Reduction in removal of riparian habitat on levees, including least Bell's vireo and valley elderberry longhorn beetle habitat	Decreased entrainment risk for delta smelt	Reduction in risk of reduced water supply resulting from more frequent bidirectional flow, salinity, and sea level rise	*[To Come]*

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Table 9-1. Assessment of Alternative Approaches to the Components of the Conservation Strategy Relative to the Proposed Conservation Strategy (continued)

Component (Approach)	*Evaluation Criteria*				
	Avoid & Minimize Take of Aquatic species	**Avoid & Minimize Take of Terrestrial Species**	**Meet Project Purpose for Species Conservation**	**Meet Project Purpose for Water Supply**	**Practicability**
Conveyance—Proposed: Tunnel/Pipeline					
East Canal	No change in effect on covered fish species	Greater loss of covered terrestrial species habitat, including California tiger salamander, giant garter snake, least Bell's vireo, and valley elderberry longhorn beetle habitat	Reduced covered terrestrial species conservation	No change in water supply	*[To Come]*
West Canal	No change in effect on covered fish species	Greater loss of San Joaquin kit fox, California red-legged frog, and California tiger salamander habitat and less loss of valley elderberry longhorn beetle habitat	Reduced covered terrestrial species conservation	No change in water supply	*[To Come]*
Through-Delta (existing channels with reinforced levees)	Greater risk for entrainment, reduced benefit of restoration, continued hydrodynamic barriers to movement of covered fish species, and increased risk for straying of covered fish species into Central Delta	Reduced impacts on covered wildlife and plant habitats	Reduced conservation of covered fish species associated with increase in entrainment risk	Reduced water supply does not meet water supply objectives	*[To Come]*

Table 9-1. Assessment of Alternative Approaches to the Components of the Conservation Strategy Relative to the Proposed Conservation Strategy (continued)

Component (Approach)	*Evaluation Criteria*				
	Avoid & Minimize Take of Aquatic species	**Avoid & Minimize Take of Terrestrial Species**	**Meet Project Purpose for Species Conservation**	**Meet Project Purpose for Water Supply**	**Practicability**
Through-Delta (Separate Corridors)	Greater risk for entrainment, reduced benefit of restoration, and physical barriers to movement of covered fish species	Reduction in impacts on habitat supporting covered wildlife and plant species	Reduced conservation of covered fish species	Reduced water supply does not meet water supply objectives	*[To Come]*
Water Operations—Proposed: 1) Near-Term South Delta Criteria and 2) North & South Delta Criteria					
Long-Term: Existing South Delta Criteria (No Project)	Greater entrainment of covered fish species	Not applicable.	Reduced conservation of covered fish species associated with greater entrainment risk	Reduced water supply does not meet water supply objectives	*[To Come]*
Long-Term: Increased Restrictions on North and South Delta Criteria (Reduced Export)	Less entrainment of covered fish species	Not applicable.	Greater conservation of covered fish species associated with reduced entrainment risk	Reduced water supply does not meet water supply objectives	*[To Come]*
Yolo Bypass Fisheries Enhancement—Proposed: Fremont Weir Improvements, Floodplain Improvements, and Fish Passage Improvements					
NMFS BO RPA	No change in effects	No change in effects	Does not provide benefits of reduction in straying potential that would result for Sacramento Weir improvements	No change in water supply	*[To Come]*
No Improvements to Fremont Weir or Yolo Bypass	All temporary impacts on covered fish species avoided	All impacts on covered wildlife and plant species avoided	Reduced conservation of covered fish species; Continuation of stranding /straying risk and barrier to movement of covered fish species	No change in water supply	*[To Come]*
Terrestrial Habitat Protection, Enhancement, and Restoration—Proposed: grassland, vernal pool complex, alkali seasonal wetland complex, and nontidal marsh					
No component approaches evaluated	Not applicable.	Not applicable.	Not applicable.	Not applicable.	Not applicable.

Table 9-1. Assessment of Alternative Approaches to the Components of the Conservation Strategy Relative to the Proposed Conservation Strategy (continued)

Component (Approach)	*Evaluation Criteria*				
	Avoid & Minimize Take of Aquatic species	**Avoid & Minimize Take of Terrestrial Species**	**Meet Project Purpose for Species Conservation**	**Meet Project Purpose for Water Supply**	**Practicability**
Tidal Habitat Restoration—Proposed: 65,000 acres in the Cache Slough Complex, Suisun Marsh, West Delta, Cosumnes/Mokelumne, and South Delta ROAs					
30,000 acres tidal habitat restoration in Cache Slough Complex, Suisun Marsh, West Delta, Cosumnes/Mokelumne, and modified-South Delta ROAs	Reduced temporary impacts on covered fish species	Reduced impacts on covered wildlife and plant species	Reduced conservation of covered fish species	No change in water supply	*[To Come]*
8,000 acres tidal habitat restoration in Cache Slough	Reduced temporary impacts on covered fish species	Reduced impacts on covered wildlife and plant species; all impacts avoided on covered wildlife and plant species that are only present in Suisun Marsh	Reduced conservation benefits provided for covered species in north Delta, no habitat benefits provided for covered species in the remainder of the Delta and Suisun Marsh	No change in water supply	*[To Come]*
No tidal habitat restoration	All temporary impacts on covered fish species avoided	All impacts on covered wildlife and plant species avoided	No conservation benefits for covered fish species; no benefits provided for tidal marsh-associated covered wildlife and plant species and intertidal covered plant species	No change in water supply	*[To Come]*

Table 9-1. Assessment of Alternative Approaches to the Components of the Conservation Strategy Relative to the Proposed Conservation Strategy (continued)

Component (Approach)	*Evaluation Criteria*				
	Avoid & Minimize Take of Aquatic species	**Avoid & Minimize Take of Terrestrial Species**	**Meet Project Purpose for Species Conservation**	**Meet Project Purpose for Water Supply**	**Practicability**
Seasonal Floodplain Restoration—Proposed: 10,000 acres restored					
20,000 acres Floodplain Restoration	Greater temporary impacts on covered fish species	Increased impacts on riparian, grassland, and terrestrial habitats	Greater conservation benefits for Sacramento splittail and covered salmonids; potential greater benefits for riparian-associated covered wildlife species if riparian vegetation in excess of 5,000 acres is allowed to establish on new floodplain surfaces	No change in water supply	*[To Come]*
No Floodplain Restoration	All impacts on covered fish species avoided	All impacts on covered wildlife and plant species avoided	No benefit of restoration to covered species	No change in water supply	*[To Come]*
Channel Margin Habitat Enhancement--Proposed: 20 miles restored					
40 miles channel margin restored	Greater temporary impacts on covered fish species	Depending on location, could result in greater removal of riparian habitat supporting covered species	Increased conservation benefits for covered fish species	No change in water supply	*[To Come]*
No channel margin restored	All impacts on covered fish species avoided	All impacts on covered wildlife and plant species avoided	No benefit of restoration to covered species	No change in water supply	*[To Come]*
Riparian Restoration—Proposed: 5,000 acres restored					
Restoration limited to extent that naturally establishes under each of the tidal habitat restoration approaches (estimated range of 20-950 acres)	No change in impacts.	Reduced impacts on wildlife associated with grassland and agricultural habitats	Substantially reduced conservation benefits for riparian-associated covered species	No change in water supply	*[To Come]*

Table 9-1. Assessment of Alternative Approaches to the Components of the Conservation Strategy Relative to the Proposed Conservation Strategy (continued)

Component (Approach)	*Evaluation Criteria*				
	Avoid & Minimize Take of Aquatic species	**Avoid & Minimize Take of Terrestrial Species**	**Meet Project Purpose for Species Conservation**	**Meet Project Purpose for Water Supply**	**Practicability**
No restoration	All impacts on covered fish species avoided	All impacts on covered wildlife and plant species avoided	No benefit of restoration to covered species	No change in water supply	*[To Come]*

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9.3 ALTERNATIVES TO TAKE

[**Note to Reviewers:** *The evaluation of Alternatives to Take will appear in the next version of this Chapter. The effects analysis of the BDCP proposed project (Chapter 5) will inform both the development and evaluation of these Alternatives to Take. As such, this section of the chapter will be completed once sufficient information is available from the effects analysis to ensure consistency among the BDCP chapters. A brief introduction to this Section 9.3 is provided.*]

The alternatives to take identified and evaluated in this chapter reflect assemblages of different approaches considered for each of the key components of the BDCP Conservation Strategy. Specifically, they are composites of different approaches to water conveyance infrastructure, water operations, habitat protection and restoration, and other conservation actions that were considered during the planning process, as described in Section 9.X. The evaluation of these alternatives is intended to illustrate why certain approaches that could potentially reduce take of covered species to levels below those anticipated for the proposed project were not adopted in the BDCP. The alternatives described in this section encompass approaches that could reduce take, avoid take, and, in some cases, increase take of covered species.

Each of the alternatives to take evaluated in this section were developed by selecting a specific approach for each component of the Conservation Strategy with each alternative differing in the combination of selected approaches. The alternatives considered are presented in Table 9-1.